

Abstract

The present invention relates to a method and arrangement for detecting a Region of Interest in an image data set, especially digitalized X-ray image. The method
5 comprises the steps of: extracting phase information from the image data, using said phase information for differentiating between different lines and edges, and skewing said lines towards a centre.

(Fig. 1)

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What we claim is:

1. A method of detecting a Region of Interest in an image data set, especially digitalized X-ray image, the method comprising the steps of:
 - 5 a. extracting phase information from the image data,
 - b. using said phase information for differentiating between different lines and edges, and
 - c. skewing said lines towards a centre.
- 10 2. The method of claim 1, wherein said step a. comprises extracting an orientation estimate.
3. The method of claim 1, wherein said step b. comprises additional information on a magnitude from a filter answer.
- 15 4. A method for detection of stellate lesions in a digitalized mammogram, the method comprising the following steps:
 - a. obtaining an image data corresponding to said mammogram;
 - b. obtaining an image mask;
 - 20 c. substantially uniformly sampling the digital image inside said mask and producing sample points;
 - d. calculating for each sample point a characteristic;
 - e. selecting a number of sampling points most likely to correspond to a spiculated lesion;
 - 25 f. applying a segmentation procedure to the original digital image at said selected sampling points;
 - g. extracting new characteristics from each segmented area and obtaining a feature vector;
 - h. classifying each feature vector as suspicious or non-suspicious using a classification machine; and
 - 30 i. examining said suspicious areas.
5. The method of claim 4 wherein said characteristics in said step d comprises one or several of:
 - 35 - contrast,
 - two measures of spiculatedness, and
 - two measures of edge orientations.

6. The method of claim 5 wherein said contrast, is derived as a ratio between intensity inside a circle with a radius r_1 and a washer shaped background area with inner radius r_1 and an outer radius r_2 .
7. The method of claim 5 wherein said two measures of spiculatedness are derived from a histogram of angle differences obtained using a filtration method that yields phase information together with orientation estimates.
8. The method of claim 5, wherein said two measures of edge orientations are derived from a histogram of angle differences obtained using a filtration method that yields phase information together with orientation estimates.
9. The method of claim 4, wherein said step e is provided using a support vector machine or an artificial neural network.
10. The method of claim 5, wherein said classification of each feature vector is provided using a classification machine.
11. The method according claim 4, wherein the entire image is sampled.
12. The method of claim 4, wherein each node in the applied sampling grid is evaluated in terms of contrast and spiculation.
13. An arrangement for detecting a Region of Interest in an image data set, especially digitalized X-ray image, which arrangement extracts phase information from said image, and uses said phase information for differentiating between different lines and edges, and skews said lines towards a centre, the arrangement comprising:
 - a processing unit,
 - a module for obtaining image masks,
 - a sampling module,
 - a calculating module, filtration module,
 - a classification module, and
 - a support vector machine and/or artificial neural network module.

14. The arrangement of claim 13, wherein said filtration module is a set of quadrature-filter.

15. An x-ray apparatus comprising an arrangement for detecting a Region of Interest in an image data set, especially digitalized X-ray image, which arrangement extracts phase information from said image, and uses said phase information for differentiating between different lines and edges, and skews said lines towards a centre, the arrangement comprising:

- a processing unit,
- a module for obtaining image masks,
- a sampling module,
- a calculating module, filtration module,
- a classification module, and
- a support vector machine and/or artificial neural network module..

16. A computer unit comprising a processing unit, a memory unit, storage unit, said computer unit being operatively arranged with an instruction set to acquire an image data set, especially digitalized x-ray image, said instruction set having procedures for: detecting a Region of Interest in a said image data, extracting phase information from said image, obtaining image masks, sampling, calculating, filtration, a classification and supporting vector and/or artificial neural network.

17. A computer program product for detection of stellate lesions in a digitalized mammogram, the program product having thereon:

- an instruction set for obtaining an image data corresponding to said mammogram;
- an instruction set for obtaining an image mask;
- an instruction set for substantially uniformly sampling the digital image inside said mask and producing sample points;
- a calculation procedure for each sample point a characteristic;
- an instruction set for selecting a number of sampling points most likely to correspond to a spiculated lesion;
- an instruction set for applying a segmentation procedure to the original digital image at said selected sampling points;
- an instruction set for extracting new characteristics from each segmented area and obtaining a feature vector; and

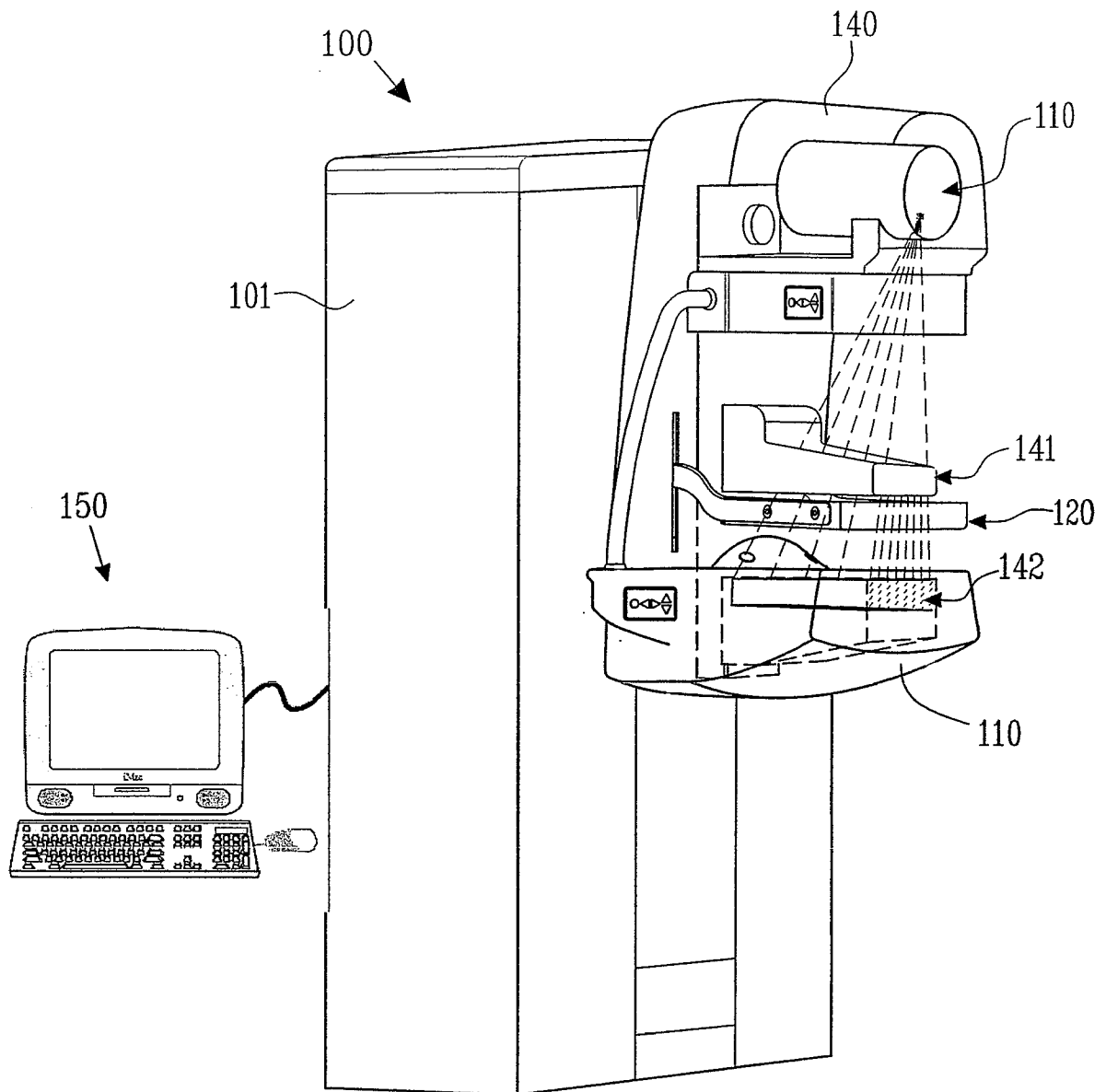
- classifying procedure for classifying each feature vector as suspicious or non-suspicious using a classification machine.

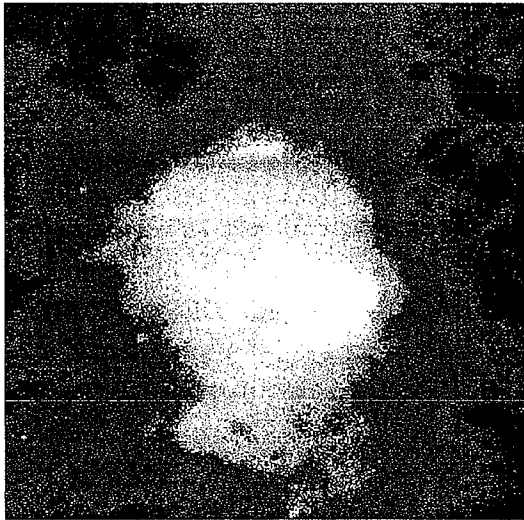
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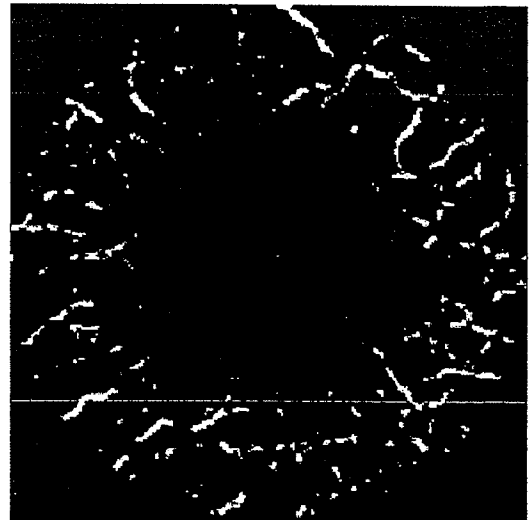
(Fig. 1)

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*Fig. 1*

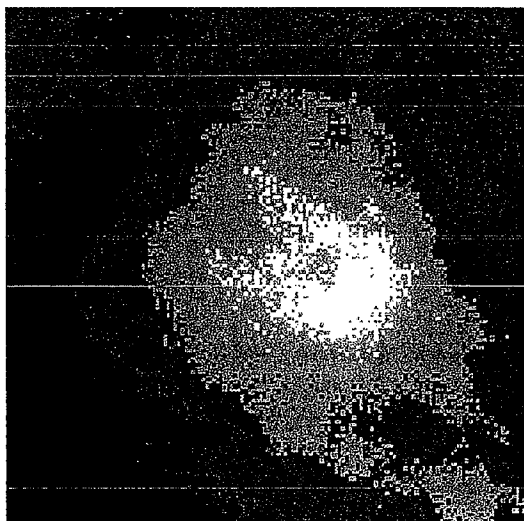


A

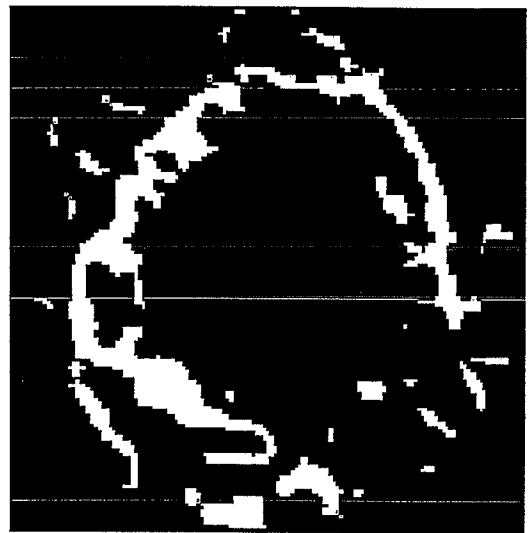


B

Fig.2

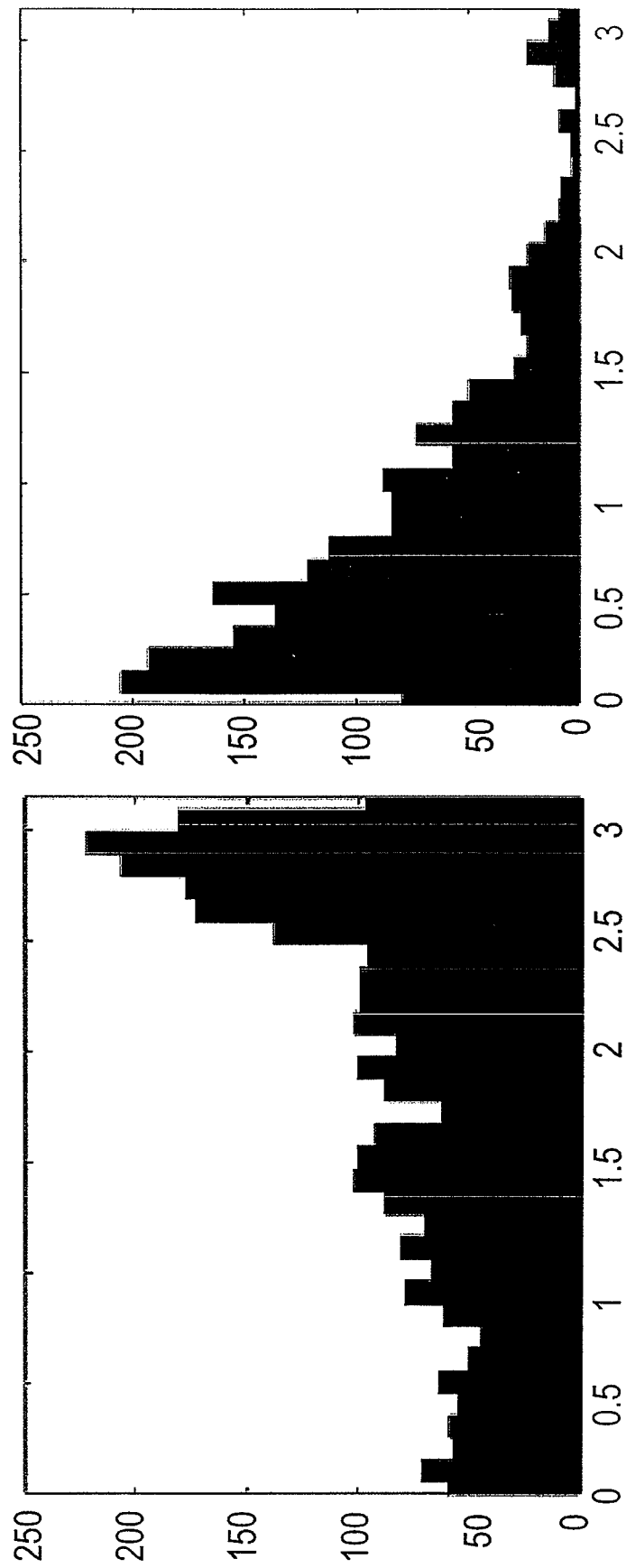


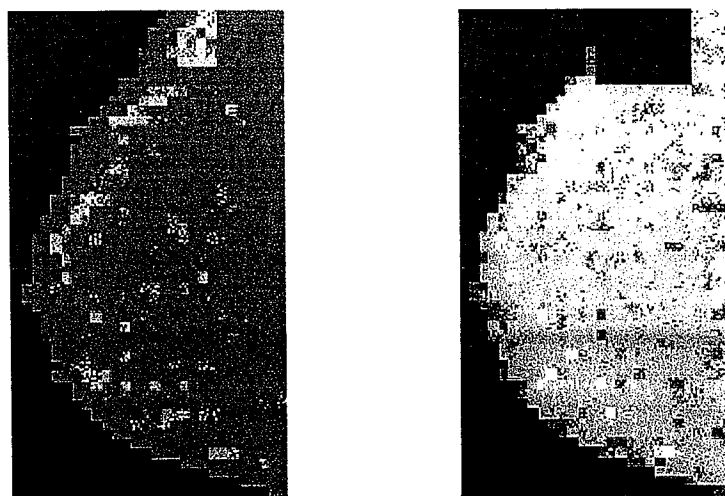
A



B

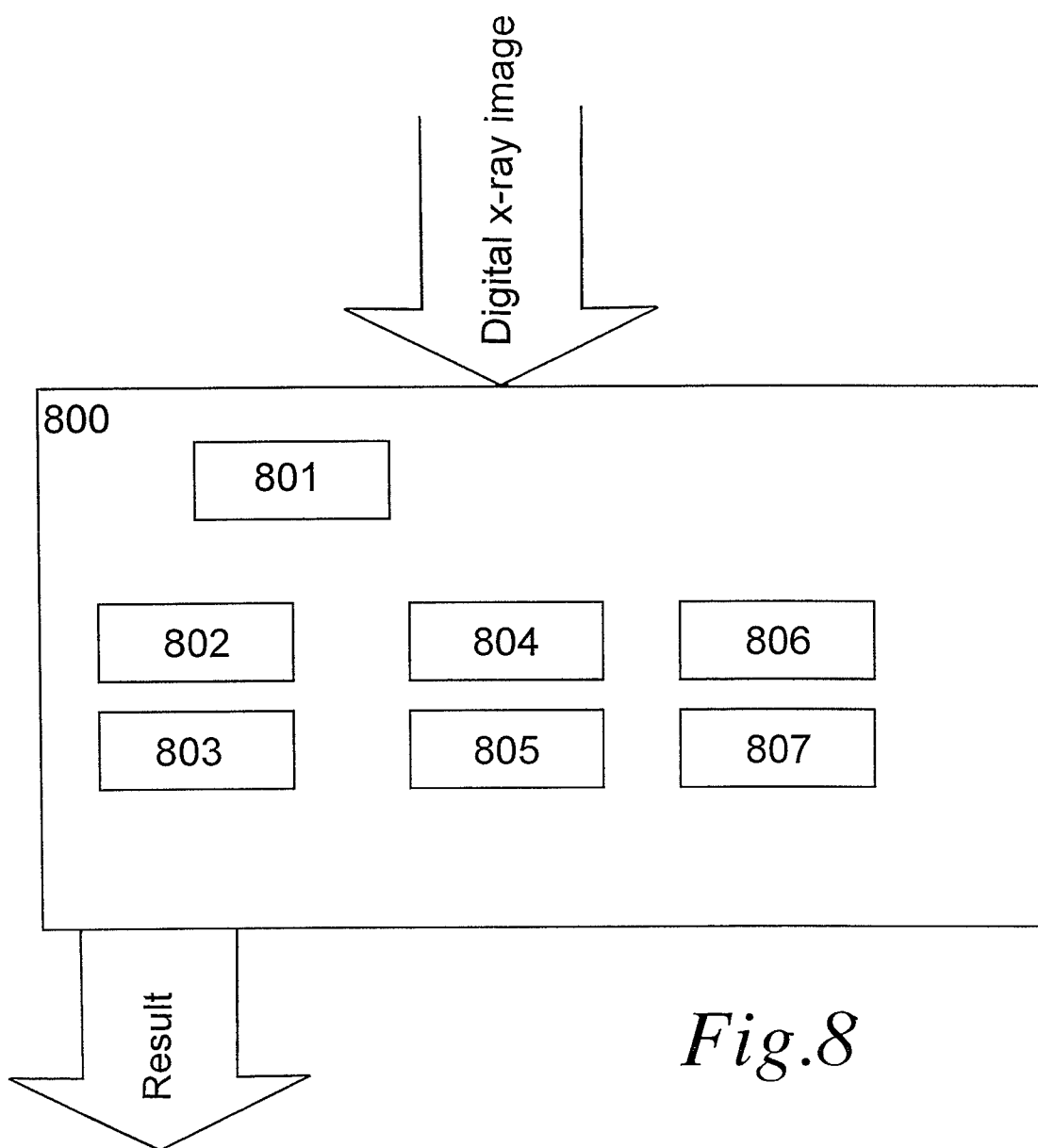
Fig.3

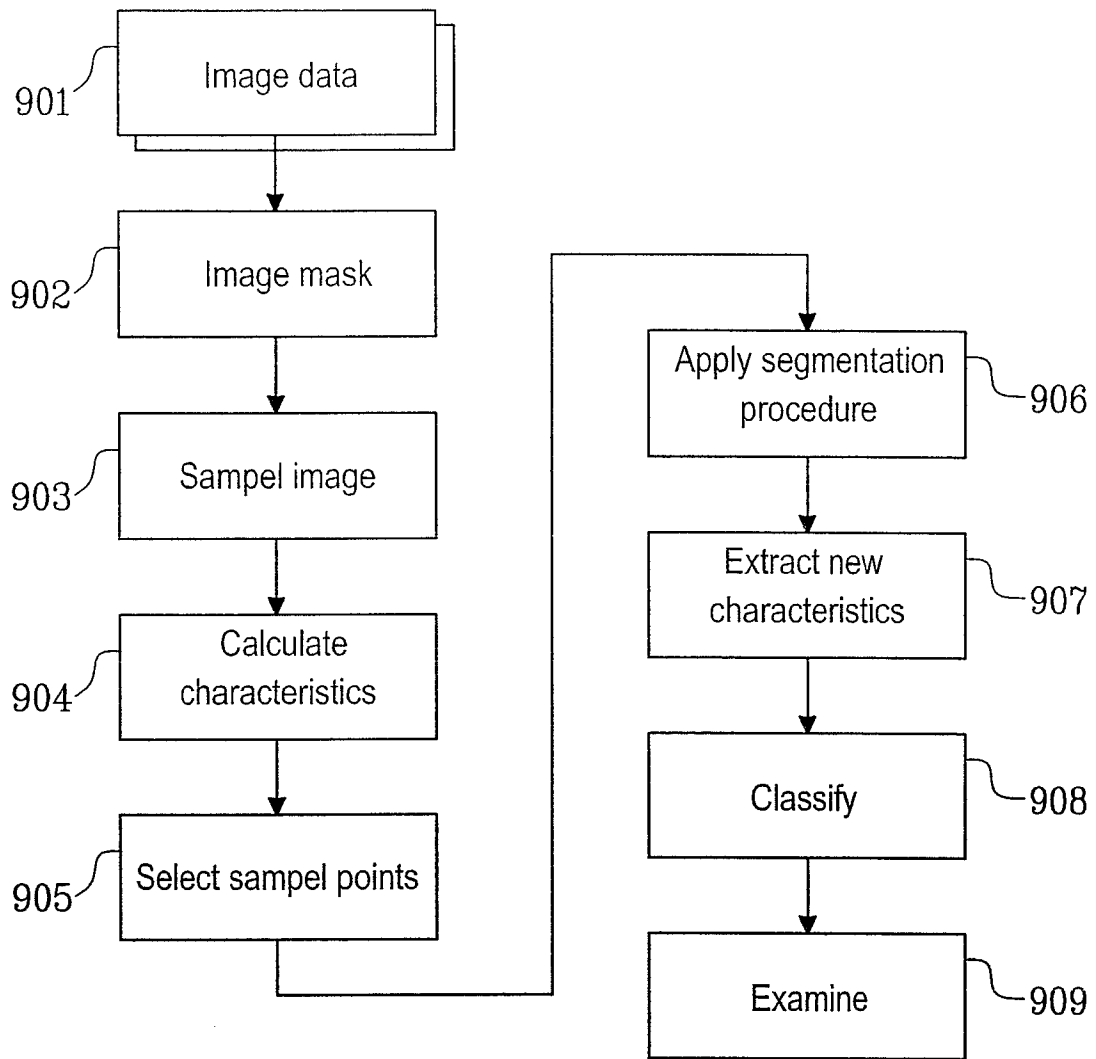
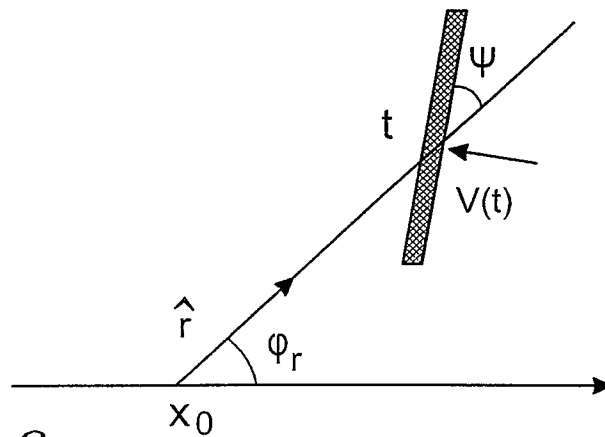
*Fig.4*



A

B

Fig.7*Fig.8*

*Fig. 9**Fig. 10*